SYNTAX ZX80®

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NEWS FROM MICROACE

MicroAce offices are open again after a 3 week holiday, and they're working on answering the letters and orders that piled up over Christmas. If you haven't been able to reach them by phone, try again.

According to Andy Fisher, MicroAce will soon market a book called The ZX80 Magic Book, containing advanced technical information and some programs. It costs $12 and MicroAce is taking orders now for the strictly mail order sales. They expect to start shipping books within the next several weeks.

For MicroAce owners, Fisher promised to send us details for using Sinclair's 8K ROM on your kits, which we will pass on to you as soon as we know of them.

8K ROM, 16K RAM UPDATES

ROM wasn't built in a day, and neither was RAM. Latest from Sinclair Research says that 8K ROMs will arrive in the US in late February. News is better for the RAMs—they're under production and in distribution in England and will be available here in late January, although European users have first crack at buying them. Sinclair is accepting orders now for RAMs, but not making firm delivery date promises. The FCC may require certain modifications to the British design. If these changes increase the ZX80's need for current, Sinclair will include a new power source in the original $99.95 price.

NEW PRODUCT UPDATES

No news is bad news in this case. Many new products reported in SYNTAX await either the 8K ROMs or the 16K RAMs for completion.

But CAI Instruments will take orders for ZX80 peripherals now. CAI offers an expansion interface, a printer and a tape mechanism. A Widget board (expansion interface) provides serial output (110 to 9600 baud), parallel output, and a tape recorder interface. Widget also drives the 20-column thermal printer. Adding the tape drive, your computer addresses & operates the tape recorder. You can call, update, and return a file to the same location. Price: printer and Widget-- $99.95, Widget only --$49.95, tape drive--$99.95. You cannot get the printer separately.

According to Robert Swann of CAI, they will accept written or phone orders now and guarantee a 6-7 week delivery (UPS) on the new Widget. Their address:

CAI Instruments
2559 Arbutus Court
Midland, MI 48640
517/835-6145

Sinclair's 10-page technical manual, reported in SYNTAX, Nov., 1980, has materialized as a 4-page manual with ZX80 schematic. It is a compendium of the technical specs and the system variable summary from the operating manual. New information includes a description of a direct video connection. Get the manual now free from Sinclair Research, Ltd., 50 Staniford St., Boston, MA, 02114, or call 617/367-2555.

SYNS OF OMISSION

Jan. 81—Bubble Sort (pp. 2-3) was written by Robert J. Schlesinger, Van Nuys, CA. We inadvertantly left his name out of the article.

Robert Demunbrun's Basic Salary Scheduling program lacked a line: 535 LET M1=M1+311 (without this line, the M+30 column is incorrect from line 12 on).

Memory Window, p. 6, contains a typo. Line 100 should read ... (16**(3-J))

The original concept and circuit for Output Port come from Tony Bringhurst, Lancaster, NY.

And finally, label the large IC 8212 in the drawing on p. 8.

Dec. 80—Martin Oakes tells us of 2 errors in Big Keyboard. First, IC10 has 16 pins, so pin 1 is directly opposite pin 16, not 14. Second, in the diagram showing how to connect keyswitches, reverse connections to IC10 pins 6 and 10 so SHIFT, A, Q, 1, 0, P, NL, and SPACE connect to pin 6.

Multiplication Exercise lacked a ; in line 40 after A$. Thanks to those who reported.

NOTE TO CONTRIBUTORS:

When you send in programs for possible publication in SYNTAX, please include the following information:

*How to operate the program, including what to input if it does not contain prompts.

*Whether you can run the program over again and how.

*How to exit the program.

*The Syntactic Sum (using program on page 7.)

*Whether it fits in 1K or 2K RAM (or 16K when available).

We pay for this explanatory text at the same rate as for articles in addition to payment for the program itself.

TV, RECORDER RECOMMENDATIONS

Many of you have written in to share advice about TVs and tape recorders that do and don't work well with ZX80s and MicroAces.

Gene Hammond, Carmel, CA found the best display from a GE 12XB9114W, retailing just over $100, and couldn't get a Sylvania to work at all. He also says a Panasonic RQ-331 recorder works perfectly. Bill Eder, Fort Ashby, WV, found among the recorders he tested, Sear's model 564.21570050 ($20) worked better than some expensive models. It has an external microphone input (in contrast with auxiliary input on some other inexpensive models).

For a comparison of several color TV models, check Consumer Reports' evaluation of 19" color TVs. Page 36 discusses nonstandard signal reception.

OUR POLICY ON CONTRIBUTED MATERIAL

SYNTAX ZX80 invites you to express opinions related to the ZX80 and the newsletter. We will print, as space allows, letters discussing items of general interest. Of course, we reserve the right to edit letters to a suitable length and to refuse publication of any material.

We welcome program listings for all levels of expertise. Programs can be for any fun or useful purpose. We will test run each one before publishing it, but we will not debug programs; please send only workable listings.

In return for your listing, we will pay you a token fee of $2.00 per program we use. This payment gives us the nonexclusive right to use that program in any form, world-wide. This means you can still use it, sell it, or give it away, and so can we.

We will consider submissions of news and hardware or software reviews. Please keep articles short (50-100 words). Again, we reserve the right to edit accepted articles to a suitable length. We will pay 7 cents per 6 characters, including spaces and punctuation, for accepted articles.

If you want us to return your original program listing or article, please include a self-addressed, stamped envelope. Otherwise, we cannot return submitted material.

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MASTERMIND

This is a ZX80 version of Mastermind, the number guessing game. The computer chooses a random secret 5 digit number. You enter a 5 digit guess, one digit at a time (hit NL between each). You get 10 points for each correct digit in a correct position and 1 point for any correct digit in a wrong position. Deduce all 5 digits and their correct order. To exit after a successful guess, enter Y (NL).

Walt Bacon, Hopewell Junction, NY

```
 10 DIM A(5)
 15 DIM B(5)
 20 DIM C(5)
 25 LET T=0
 30 RANDOMISE
 35 FOR J=1 TO 5
 40 LET A(J)=(RND(10)-1)
 45 NEXT J
 50 CLS
 55 FOR J=1 TO 5
 60 LET C(J)=0
 65 NEXT J
 70 PRINT "ENTER 1ST DIGIT OF G
UESS"
 75 INPUT B(1)
 80 PRINT "2ND DIGIT?"
 85 INPUT B(2)
 90 PRINT "3RD?"
 95 INPUT B(3)
100 PRINT "4TH?"
105 INPUT B(4)
110 PRINT "5TH?"
115 INPUT B(5) "
120 PRINT B(1);B(2);B(3);B(4);B
(5)
125 LET S=0
130 FOR J=1 TO 5
135 IF NOT A(J)=B(J) THEN GO TO
150
140 LET S=S+10
145 LET C(J)=1
150 NEXT J
155 FOR J=1 TO 5
160 FOR K=1 TO 5
165 IF NOT A(J)=B(J) AND C(K)=0
AND B(J)=A(K) THEN GO TO 175
170 GO TO 190
175 LET S=S+1
180 LET C(K)=1
185 GO TO 195
190 NEXT K
195 NEXT J
200 LET T=T+1
205 PRINT "SCORE IS ";S;" TRIES
=";T
210 IF S=50 THEN PRINT "CONGRAT
ULATIONS. MORE? ENTER M"
215 IF NOT S=50 THEN PRINT "GIV
E UP? ENTER Y OR HIT NEWLINE"
220 INPUT D$
225 IF D$="" THEN GO TO 50
230 IF D$="M" THEN GO TO 10
235 PRINT A(1);A(2);A(3);A(4);A
(5)
```

Syntactic Sum= -6629

SON OF BIG CHARACTERS

John Filley of Nashville, TN, sent us a new Big Characters program, saying "Big Characters in the Dec. 80 issue had the serious limit of handling only 2 lines of 4 characters each...a 4x display should be more useful." We agreed, and liked his approach. Our technical consultant, using John's method to read 2 rows and 2 columns of the ROM image at once, produced this improved program.

(This exchange shows SYNTAX's power to help you get more from your machine. User interactions produce better software.)

The REM statement creates a subset of the graphics characters in a special order and in known RAM addresses, making it easier to build large characters. The space and 15 solid graphics form all 4x characters. They are ordered so the sum of 16427 and the weights of blackened elements will equal the RAM address of the character code. Putting the REM statement first fixes the address of the space following REM at 16427.

On a 1K machine, this program prints up to 5 lines with 34 total characters, including internal spaces. With 2K or 16K RAM, it should print 5 8-character lines

and a 6th line with the bottom squares cut off, giving a 5/110 error when you run out of room.

To first enter the program, type it as shown, then RUN (NL). Enter the numbers shown below, hitting (NL) between each. After you enter all 16 numbers, the string prompt appears. Type (NL) and then quickly (BREAK) to end the RUN. Get the listing back up. Delete lines 6-9. Line 2 now says 2 REM [illegible]. Save this version on tape.

Hit RUN (NL), then enter up to 8 characters for each prompt. It will ignore characters over 8 in one line.

```
   2 REM ABCDEFGHIJKLMNOP
   5 DIM C(7)
   6 FOR X=0 TO 15
   7 INPUT E
   8 POKE 16427+X,E
   9 NEXT X
  10 INPUT A$
  20 FOR X=0 TO 7
  30 LET C(X)=CODE(A$)
  35 IF C(X)=1 THEN GO TO 57
  40 LET A$=TL$(A$)
  50 NEXT X
  57 LET E=X-1
  60 LET L=1
  70 FOR X=0 TO E
  80 LET Q=C(X)*8+3583+L
  85 LET R=PEEK(Q+1)
  90 LET Q=PEEK(Q)
  95 LET B=128
  97 LET B2=B/2
 110 PRINT CHR$(PEEK(16427+(Q AN
D B)/B+4*(Q AND B2)/B2+2*(R AND
B)/B+8*(R AND B2)/B2));
 170 LET B=B/4
 175 IF B>0 THEN GO TO 97
 250 NEXT X
 255 LET L=L+2
 257 PRINT
 260 GO TO 10-60*(L<9)
Syntactic Sum= -32591
```

Enter these 16 numbers in this order when you first type in the program, hitting (NL) after each:
0 4 6 2 5 131 8 135 7 136
3 133 130 134 132 128

ADDITION THROUGH 7 DIGITS

With 8 bit words, the ZX80 can handle numbers up to only 5 digits. This program enables you to add 7 digit numbers, so long as their total doesn't exceed 7 digits. After hitting RUN (NL), respond with a number up to 7 digits. Hit (NL) and that number appears on the screen. Enter another number (NL). The running total appears. Zeros show only as spaces. To see zeros, change line 260 to PRINT "0";, but then you will get 7 digit numbers with zeros as place holders. To change the number of usable digits, change lines 5, 7, 200, and 210.

Francis LeBaron, Brockton, MA

```
   5 DIM X(7)
   7 DIM Y(7)
  10 INPUT A$
  20 FOR N=1 TO 7
  30 LET X(N)=CODE(A$)-28
  35 IF X(N)<0 THEN GO TO 70
  37 IF X(N)>9 THEN STOP
  50 LET A$=TL$(A$)
  60 NEXT N
  70 LET M=N-1
  80 FOR I=1 TO N-1
  90 LET Y(I)=Y(I)+X(M)
  97 IF Y(I)>9 THEN GO TO 130
 100 LET M=M-1
 110 NEXT I
 120 GO TO 200
 130 LET Y(I)=Y(I)-10
 140 LET Y(I+1)=Y(I)+1
 150 GO TO 95
 200 LET M=7
 202 LET FL=0
 210 FOR I=1 TO 7
 212 IF FL>0 THEN GO TO 220
 214 IF Y(M)=0 THEN GO TO 260
 215 LET FL=0
 220 PRINT Y(M);
 230 LET M=M-1
 240 NEXT I
 245 PRINT
 250 GO TO 10
 260 PRINT " ";
 270 GO TO 230
Syntactic Sum= -28812
```

PHONE DIALER

Using this circuit and program, you can turn your ZX80 into a programmable phone dialer! The circuit consists of three modules: address decoding, data latching. and a relay.

In effect, the address decoder ANDs MREQ (memory request), WR (write), A12, A13 and A14. This results in a positive logic signal at pin 10 of the 7402, which is true whenever the computer tries to write to any address in the range 3000-3FFF.

This signal controls a single bit latch (1/4 7475) having D0 as its data input. Thus the latch stores the lowest order bit of the last write to address 3000. So POKE 12288,1 causes the latch's output to go high; POKE 12288,0 lowers the latch output.

The relay is controlled by the latch through a high current driver consisting of an open-collector TTL inverter. It can sink 23 mA from the 220Ω resistor used to turn on a RS 276-2009 (Radio Shack catalog no.) NPN transistor, grounding the relay.

We built our dialer first on a prototyping board, then moved it onto a Radio Shack 276-170 printed circuit experimenter's board. We housed it in a Radio Shack project case and grounded the metal lid to reduce interference.

The transistor we used cannot be driven directly from the latch; it doesn't have enough current capability. Also, do not omit the diode across the relay coil since it clamps the spike caused by the coil's collapsing field. Supply power to the circuit board near the relay since it takes 100 mA.

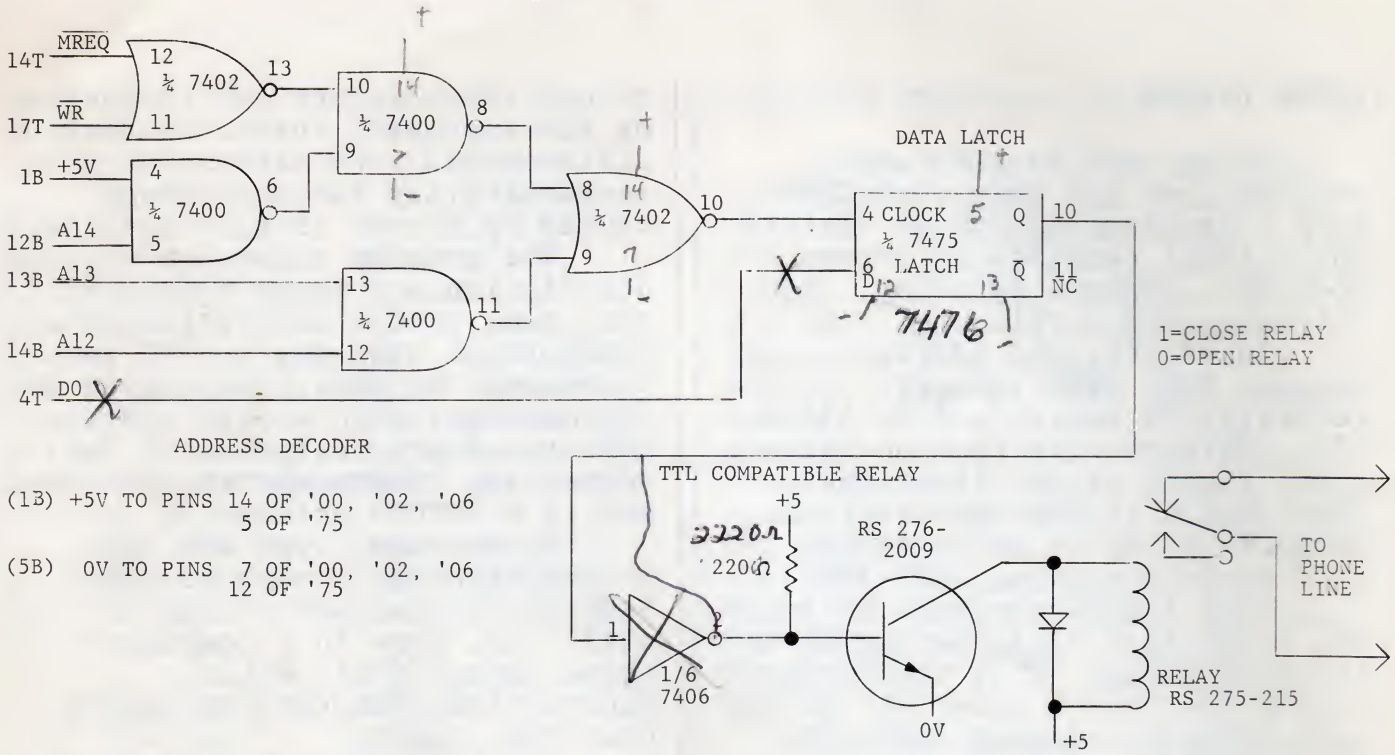
Connect the dialer normally closed in series with the tip (non-ground, usually red wire) half of the phone wire. The phone must be off-hook to dial. Note that this is a prototype dialer and does not incorporate many things (such as optical isolation or FCC approval) that a production dialer would. We take no responsibility for any damage caused by use of this dialer.

The program takes the description and phone number of each name in its memory from the subroutines starting at 700 and increments by tens. Add up to 10 subroutines; each should contain LET statements assigning N$ the number and D$ its description, and end in a RETURN statement.

To operate, type RUN (NL). Screen displays a menu of names. Respond with a letter (NL) to dial. Or, type in a complete phone number (NL), without punctuation, for the program to dial that number.

As shown, the program works in 1K with up to 10 names. When you have more memory, you can raise the ending value of the loop at line 100. If your phone company has older equipment, it may need larger numbers in the loops in lines 540, 570, and 600 to increase the relay cycle times.

```
 50 POKE 12288,1
100 FOR G=1 TO 10
120 GO SUB 690+G*10
130 PRINT CHR$(G+37);" ";D$
140 NEXT G
145 CLEAR
150 INPUT N$
155 CLS
156 LET G=CODE(N$)-37
157 IF G<1 THEN GO TO 400
160 GO SUB 690+G*10
400 GO SUB 500
430 GO TO 100
500 LET N=CODE(N$)-28
505 LET N$=TL$(N$)
510 IF N=-27 THEN RETURN
515 IF N=0 THEN LET N=10
520 FOR P=1 TO N
530 POKE 12288,0
540 FOR S=1 TO 10
550 NEXT S
560 POKE 12288,1
570 FOR S=1 TO 10
580 NEXT S
```



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```
 590 NEXT P
 600 FOR S=1 TO 100
 610 NEXT S
 620 GO TO 500
 700 LET D$="UNCLE JIM"
 702 LET N$="15553423"
 704 RETURN
 710 LET D$="DIR. ASSISTANCE"
 712 LET N$="411"
 714 RETURN
 720 LET D$="EMERGENCY"
 722 LET N$="911"
 724 RETURN
 900 LET D$="BLANK"
 902 LET N$=""
 904 RETURN
Syntactic Sum= -27616
```

Use diagram on page 6 to construct your ZX80 dialer.

SYNTACTIC SUMS

To allow you to easily check programs typed into your ZX80 from SYNTAX, we will print a Syntactic Sum™, a number unique to the exact program form, after each listing we publish. Using the following program, you can verify your typing immediately after entry.

To make a cassette containing the Syntactic Sum™ program, start with a blank tape. (See below if you have more than 1K memory.) Type Program 1 and save it on the tape. Allow the tape to record about 2 seconds of screen hiss after the program is saved. Now type NEW (NL) and type in Program 2. Run Program 2, and input the numbers from the Decimal Listing, hitting (NL) after each. When you have typed in the final number, error 9/5 will appear. Hit any key to display the listing, then delete lines 1-5. Save lines 6-9 on the tape just after Program 1.

If you have more than 1K RAM, change the number in line 6 in Programs 1 and 2 to the amount of memory you have (in bytes, where 1K = 1024 bytes). For example, if you have a 2K MicroAce, change it to 2048. To run Syntactic Sum™ use 16352+your RAM size as the address (PRINT USR(18400) (NL) for 2K).

To load Syntactic Sum™, rewind the tape and load Program 1. Run it immediately and the screen will clear. Type LOAD (NL) when the cassette reaches the silent leader of Program 2. (If you use our cassette eavesdropper, just let the cassette keep going as you run the first program and type LOAD (NL) when Program 2's leader comes up.) After loading Program 2, stop the recorder and type GO TO 6 (NL). It is very important to type GO TO 6 and not RUN, because RUN will destroy array variable P. After the program has run, do not type NEW! If you do, you erase the Syntactic Sum™ program hidden in memory. Erase Program 2 by typing 6 (NL) 7 (NL) 8 (NL) 9(NL), or by loading a program from tape.

After Programs 1 and 2 have been run, enter any BASIC program. To find the Syntactic Sum™ of the BASIC program in memory, type PRINT USR(17376) (NL) (If you have more than 1K, use a different address). The number appearing on the display equals the published Syntactic Sum™ when both programs are identically typed. You can also write the Syntactic Sum™ of your own programs on the cassette labels to check for a good load.

Program 1 sets aside 32 bytes of ZX80 RAM for Syntactic Sum™ (Thanks to David Ornstein of Sinclair Research Ltd. for this technique). If you type NEW (NL) you will erase this memory, protected from your BASIC programs. Program 2 loads machine language code to calculate the Syntactic Sum™. If your BASIC program runs out of memory with Syntactic Sum™ loaded, then save the BASIC program on cassette, type NEW (NL) to erase Syntactic Sum™, and reload the BASIC. Most programs will fit, but if they are normally cramped for space, they will not execute.

PROGRAM 1.

```
  6 LET M=1024
  7 LET M=M+16351
 10 POKE 17152,33
 20 POKE 17153,M-(M/256)
 30 POKE 17154,M/256
 40 POKE 17155,195
 50 POKE 17156,107
 60 POKE 17157,2
 70 LET X=USR(17152)
```

PROGRAM 2.

```
  1 DIM P(31)
  2 FOR L=1 TO 31
  3 INPUT P(L)
  4 NEXT L
  5 STOP
  6 LET M=1024
  7 FOR L=M+16352 TO M+16382
  8 POKE L,P(L-M-16351)
  9 NEXT L
```

SYNTACTIC SUM —DECIMAL LISTING

```
 33  40  64 237  91   8  64 221
 33   0   0 124 186  32   8 125
187  32   4 221 229 225 201  78
  6   0 221   9  35  24 236
```

SYNTACTIC SUM —ASSEMBLY LISTING

```
                        ORG   43E0H
                RAMBOT  EQU   4028H
                VARS    EQU   4008H
43E0 212840     START   LD    HL,RAMBOT   ;WHERE TO START
43E3 ED5B0840           LD    DE,(VARS)   ;WHERE TO END
43E7 DD210000           LD    IX,0000     ;PUT 0 IN IX
43EB 7C         REPT    LD    A,H         ;COMPARE HL TO DE
43EC BA                 CP    D
43ED 2008               JR    NZ,ADDIN    ;IF B <> D
43EF 7D                 LD    A,L
43F0 BB                 CP    E
43F1 2004               JR    NZ,ADDIN    ;IF L <> E
43F3 DDE5               PUSH  IX          ;PUT ANSWER (IX)
43F5 E1                 POP   HL          ;IN HL FOR BASIC
43F6 C9                 RET               ;RETURN TO BASIC
43F7 4E         ADDIN   LD    C,(HL)      ;GET ANOTHER BYTE
43F8 0600               LD    B,0         ;ZERO THE HI BYTE
43FA DD09               ADD   IX,BC       ;ADD INTO THE SUM
43FC 23                 INC   HL          ;GO TO NEXT BYTE
43FD 18EC               JR    REPT        ;AND DO IT AGAIN
                        END   START
```


ZX80 "THIS BOOK IS EXCELLENT!"
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'30 PROGRAMS FOR THE SINCLAIR ZX-80:1K' is a unique 112 page book which contains 30 programs all designed to fit into your basic 1K version of the Sinclair ZX-80. In programs which go far beyond anything that has been published the authors show the unique capabilities of the Sinclair ZX-80. The ZX-80 is more powerful than you ever thought!

BLACKJACK - actually contains a full pack of cards, shuffles them, keeps track of the dealer and player card totals, and the money bet, all within 1K.

MEMORY LEFT - an incredible routine, especially useful as it enables you to know exactly how much memory is left, even during the running of a program. This also illustrates USR routines.

DR. ZX-80 - a conversational program with the computer as analyst which uses an ingenious method of storage.

GOMUKU - the computer challenges you to this complex Japanese game. Incredibly this program including display of the 7 x 7 board, fits into 1K; it only does so because it uses the display as memory!

Other programs included are HORSE RACE, LUNAR LANDER, (with moving spaceship), NOUGHTS & CROSSES, NIM, SIMPLE SIMON, HANGMAN, LIFE, MASTERMIND, PINCH and 17 others.

As well as the programs, the book illustrates programming techniques you can use in your own programs - space compression, PEEKs and POKEs, USRs and so on.

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Orders to: Image Computers Products, 615 Academy Drive, Northbrook, Illinois
Please add $1 for post and packing.

Syntax, Inc. hereby grants everyone the right to use the Syntactic Sum™ program to generate Syntactic Sums™ and to publish them with programs. Republication of this program is strictly prohibited without our written consent.

DEAR EDITOR:

I had no problem assembling my 2K MicroAce kit except that I could not insert the cylinders into the plastic rivets that hold the case together. I used round wooden toothpicks instead and they worked great.

John W. Walsh, Van Nuys, CA

I had trouble loading from my cassette tape one day because the recorder was too close to the 19" color TV I was using a monitor. When I moved the recorder away from the TV's magnetic field, the loading went as normal.

John A. Sampson, College Point, NY

As a novice microcomputer enthusiast, I am unsure of the microcomputer community protocol. Several questions: Is it permissible to adapt published copyrighted programs written for one system to run on another? Second, my apartment is near a powerful communications tower that causes severe interference for my ZX80 RF modulator. I have found only one kind of TV that produces a steady display. Would naming this brand amount to an endorsement and hence be unacceptable for publishing in SYNTAX? Finally, I do not yet have a printer. Rather than writing out program listings, would you accept a cassette tape containing the program itself?

Colin Alexander, San Francisco, CA

Copyright laws concerning software are nebulous at best. In regular literary copyrights, US law states that only the actual expression of information is copyrightable; you cannot copyright the information or ideas themselves. Strictly interpreted, adapting existing programs for another system may be legally OK. To be on the safe side, ask for permission to reuse a published program. For further information, see the Oct., 1980 issue of 80 Microcomputing.

We do not object to printing the brand names of any product useful to ZX80 and MicroAce users. Part of our function is to provide you with objective reviews of available hardware, and TVs certainly fall into this category. Check page 2 for some reader's comments on TVs and recorders.

We will accept cassette tapes containing programs as submissions until such time as we find it too complicated or unworkable.—AZ

Using the instructions in the Dec., 1980, issue of SYNTAX, I put a switch between B and C on my ZX80's PC board to reverse the video display. But the white-on-black display was impossible to read, although the black-on-white display was the same as always. I prefer the white-on-black display. How can I remedy this? Also, is the book of programs on page 3 of the Jan., 1981, issue the same as the catalog to be sent to all ZX80 owners, as reported on page 1 of the Dec., 1980, issue?

Bill Cothan, Winston-Salem, NC

Check Bill Eder's advice, next letter.

Second, the book advertised on page 3, Jan , 1981, is published by Melbourne House, an Australian publisher. Although it is available in the US through Image Computer Products, it is not the same as Image's catalog of its own products, which it distributes free.—AZ

I simplified your cassette eavesdropper (Dec., 1980) by soldering the 1K resistor to one leg of one of the 3.5 mm jack plugs, attaching one earplug wire to the other leg of the plug and

the other earplug wire to the other end of the resistor. The whole assembly is small enough to fit right inside the plastic handle of the plug itself with the thin earplug wires coming out of the handle next to the regular connector wire. I have had no interference problems and the arrangement works great when loading programs into the ZX80.

To improve Paul Byrne's interference problem, try reversing the video output. Turn the brightness control on the TV down until the screen is almost completely dark, then turn down the contrast. The characters are easier to read with no noticeable interference patterns.

Bill Eder, Fort Ashby, WV

Amateur radio operators wishing to share programs related to amateur radio can contact K2MI, Marty Irons, 46 Magic Circle Dr., Goshen, NY, 10924, 914/294-9462.

Joe Carroll would like to communicate with other ZX80 and MicroAce users in the Huntsville and North Alabama area. Call 205/852-6527 between 10AM and 2PM or between midnight and 2AM or write Joe at 3422 Mimosa Ln, Huntsville, AL, 35810.

SYNTACTIC SUMS FOR PAST 4K ROM PROGRAMS IN SYNTAX ZX80

Nov. 80:
- Cryptoquote---1796
- 12 Days of Christmas--5358

Dec. 80:
- Big Characters—25918
- Multiplication Exercise—1376
- Season's Greetings---27631
- Compu-Calendar—22279

Jan. 81:
- Bubble Sort—32552
- Basic Salary Sched—28578
- Memory Window— -20799
- Bytes to the Line—-28932
- Computer Model—-27135

COMPUTER NUMBER SYSTEMS

Your ZX80 or MicroAce computes for you in decimal numbers, the number system we all learned to count in. But it thinks in another number system, called binary. Instead of 10 digits. 0-9, in the decimal system, binary has only 2—0 and 1 (hence the name binary).

When you see a decimal number such as 24, you know it means 2 tens (twenty) plus 4 ones (four). Another way to look at it is $2x10^1$ plus $4x10^0$. Each place represents a power of 10. Binary works the same way, except that each place represents a power of 2. For example, 1011 means $1x2^3$ plus $0x2^2$ plus $1x2^1$ plus $1x2^0$, for a total of 11 in decimal. (Remember, any number to the zero power=1)

Why is this useful? All digital computers, like the ZX80, work in this base 2 system. The ZX80 converts everything to binary digits (or "bits") and handles them in 8-bit units, called bytes.

Each keystroke uses 1 byte of memory space in your computer. A ZX80 comes with 1K memory, and some MicroAces with 2K. This means you have 1024 (2^{10}) bytes available in your ZX80, 2048 (2^{11}) in your MicroAce. (Computer users round to 1K and 2K respectively. The 16K RAM will really have 16384 (2^{14}) bytes of memory available.)

Before you can get into the gut workings of your computer, you must understand that it works in a different number system than you do. Later we'll see how you can use binary numbers to decode addresses in memory or manipulate graphics (for example, Big Characters—see page 3—reads the binary representation of each line of a character's video image and expands it).

These 2 programs, by Bill Herron of San Diego, convert decimal numbers to binary and back. In later issues Bill and J

will show you how to convert to hexidecimal (base 16) and octal (base 8) numbers, other number systems used with computers. To run the DEC to BI program again, just hit NL. To exit, hit any key then NL. To run the BI to DEC program again, change line 430 to RUN. To exit, hit NL then BREAK while the screen is blanked.

```
  1 REM DECIMAL TO BINARY
100 PRINT "D=";
110 INPUT D
120 PRINT D
200 PRINT "BI=";
205 LET MSK1=-32767-1
210 FOR Z=1 TO 16
220 PRINT (D AND MSK1)/MSK1;
230 LET MSK1=ABS(MSK1/2)
240 NEXT Z
250 PRINT
1000 INPUT Z$
1020 IF Z$="" THEN GO TO 100
Syntactic Sum= 14416
```

NOTE—Range: $-32768 \leq D \leq 32767$
$0_2 \leq BI \leq 1111111111111111_2$

```
100 REM BINARY TO DECIMAL
110 DIM X(14)
112 DIM Y(14)
114 LET A=10**4
120 LET X(0)=2**13
130 FOR I=1 TO 14
140 LET X=X(I-1)*2
142 LET C=X/A
144 LET X(I)=X-C*A
150 LET Y(I)=Y(I-1)*2+C
160 NEXT I
170 DIM B(27)
200 PRINT "BI=";
204 INPUT B$
206 LET F=0
210 FOR I=0 TO 27
220 LET B=CODE(B$)
230 IF B=1 THEN GO TO 292
234 IF B=29 THEN LET F=1
240 IF B<30 AND B>27 AND F>0 THEN
GO TO 270
250 LET B$=TL$(B$)
260 GO TO 220
270 LET B(I)=B-28
275 PRINT B(I);
280 LET B$=TL$(B$)
290 NEXT I
292 LET S=I-1
294 IF S<0 THEN GO TO 297
295 PRINT
296 GO TO 300
297 LET S=0
298 PRINT S
300 LET U=0
305 LET L=0
320 FOR I=0 TO S
330 IF B(I)=0 THEN GO TO 380
340 IF S-I>12 THEN GO TO 350
342 LET X=2**(S-I)
344 LET Y=0
346 GO TO 360
350 LET X=X(S-I-13)
352 LET Y=Y(S-I-13)
360 LET L=L+X
362 LET C=L/A
364 LET L=L-C*A
370 LET U=U+Y+C
380 NEXT I
400 PRINT "DEC=";
410 IF U>0 THEN GO TO 413
411 PRINT L
412 GO TO 430
413 PRINT U;
420 PRINT TL$(STR$(L+A))
430 CLEAR
Syntactic Sum= -3481
```

NOTE—Range: $0 \leq DEC \leq 268435455$
$0_2 \leq BI \leq 11111111111111111111111111111_2$

ROM V. RAM

Last week a beginner told me he couldn't run SYNTAX programs. I was very surprised, since I test every program we print myself. He tried to use 8K ROM programs on his 4K ROM. He didn't understand the difference between the 2 ROMs, or what ROMs or RAMs are.

ROM stands for read only memory. Your ZX80 or MicroAce has a 4K ROM memory chip (see binary number story for discussion of 4K). This chip holds instructions designed by the manufacturer for the computer. You cannot alter the ROM--it's read only. The new 8K ROM will contain 4K more instructions for the computer, so it will have greater capabilities.

You also have 1K or 2K RAM, or random access memory, depending on your machine. RAM stores the data and instructions you type in. The machine needs 40 bytes to store system variables, but the rest is yours to fill with programs.

INCREMENT, DECREMENT FOR-TO'S

Using the ZX80's BASIC FOR-TO statement, you can only increase the control variable by 1. But you can insert a LET statement to either increment or decrement the loop index. To increase by 5 steps, add line 20:

```
10 FOR J=100 TO 200
20 LET J=J+4
30 PRINT J
40 NEXT J
```

In general, +1 increments by 2, +2 increments by 3, and X increments by (X+1). To display Y through Z, use Y-X and Z-X in line 10.

To decrement, use the same starting and ending values in the FOR-TO statement:

```
10 FOR J=104 TO 104
20 LET J=J-4
30 PRINT J
40 NEXT J
```

In general, -X in line 20 decrements the loop index by (X-1). You must usually stop a decrement, so add a line:

```
35 IF J=49 THEN STOP
```

making sure that 49 falls in the decremented progression.

In general, use Y+X to start with Y and decrement by (X-1).

D.J. O'Connell Jr, San Antonio, TX

Another scheme to decrement loops:

```
100 FOR P=0 TO 7
110 LET B=7-P
120 NEXT P
```

Use B as decremented value. The 2 numbers in lines 100 and 110 (in this case 7) must be the same.—AZ

When your program gets dull or you're stuck in an endless loop and the break key gives you " " because it wants input, you can get out without pulling the power. If the required input is numeric, enter XX (NL). If it is a string, space forward and erase the quote marks, then type CHR$(XX) (NL).

Tip from Alfred Milgrom, Collingwood, Victoria, Australia

SYNTAX

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